OSCAR

Open
Systems
Core
Avionics
Requirement

Nick Carter
OSCAR Applications Manager

REPORT DOCUMENTATION PAGE

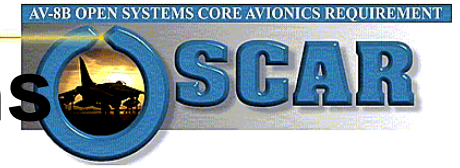|	
1. REPORT DATE (DD-MM-YYYY) 29-04-1998	2. REPORT TYPE Briefing
3. DATES COVERED (FROM - TO) xx-xx-1998 to xx-xx-1998	

4. TITLE AND SUBTITLE
Open Systems Core Avionics Requirement
Unclassified

5a. CONTRACT NUMBER
5b. GRANT NUMBER
5c. PROGRAM ELEMENT NUMBER

6. AUTHOR(S)
Carter, Nick ;

5d. PROJECT NUMBER
5e. TASK NUMBER
5f. WORK UNIT NUMBER

7. PERFORMING ORGANIZATION NAME AND ADDRESS
Boeing
xxxxx
xxxxx, xxxxxxx

8. PERFORMING ORGANIZATION REPORT NUMBER

9. SPONSORING/MONITORING AGENCY NAME AND ADDRESS
Open Systems Joint Task Force (OSJTF)
1931 Jefferson Davis Highway
Crystal Mall 3, Suite 104
Arlington, VA22202

10. SPONSOR/MONITOR'S ACRONYM(S)

11. SPONSOR/MONITOR'S REPORT NUMBER(S)

12. DISTRIBUTION/AVAILABILITY STATEMENT
APUBLIC RELEASE
,

13. SUPPLEMENTARY NOTES

14. ABSTRACT
See Report.

15. SUBJECT TERMS

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT Public Release	18. NUMBER OF PAGES 18	19. NAME OF RESPONSIBLE PERSON http://www.acq.osd.mil/osjtf/library/library_alpha.html (blank) lfenster@dtic.mil
a. REPORT Unclassified	b. ABSTRACT Unclassified	c. THIS PAGE Unclassified			19b. TELEPHONE NUMBER International Area Code Area Code Telephone Number 703767-9007 DSN 427-9007

AV-8B Fleet Configurations

- **Harrier II Plus**
  - ❏ **APG-65 Multimode Radar**
  - ❏ **Night Attack**
  - ❏ **Provisions for Beyond Visual Range Weapons**

- **Night Attack**
  - ❏ **NAVFLIR/Night Vision Goggles**
  - ❏ **Digital Moving Map**
  - ❏ **Triples the Number of Expendables**

- **Day Attack / Trainer**
  - ❏ **Twice Payload/Radius AV-8A**
  - ❏ **Digital Avionics/Integrated Cockpit**

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OSCAR Vision
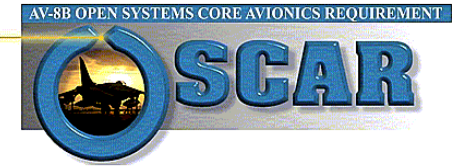
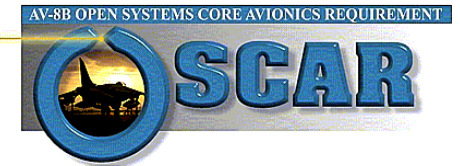"To Significantly Reduce the Life Cycle Support Costs of the AV-8B Avionic System Through the Application of Open System Principles, Commercial Technologies and Acquisition Reform Initiatives"
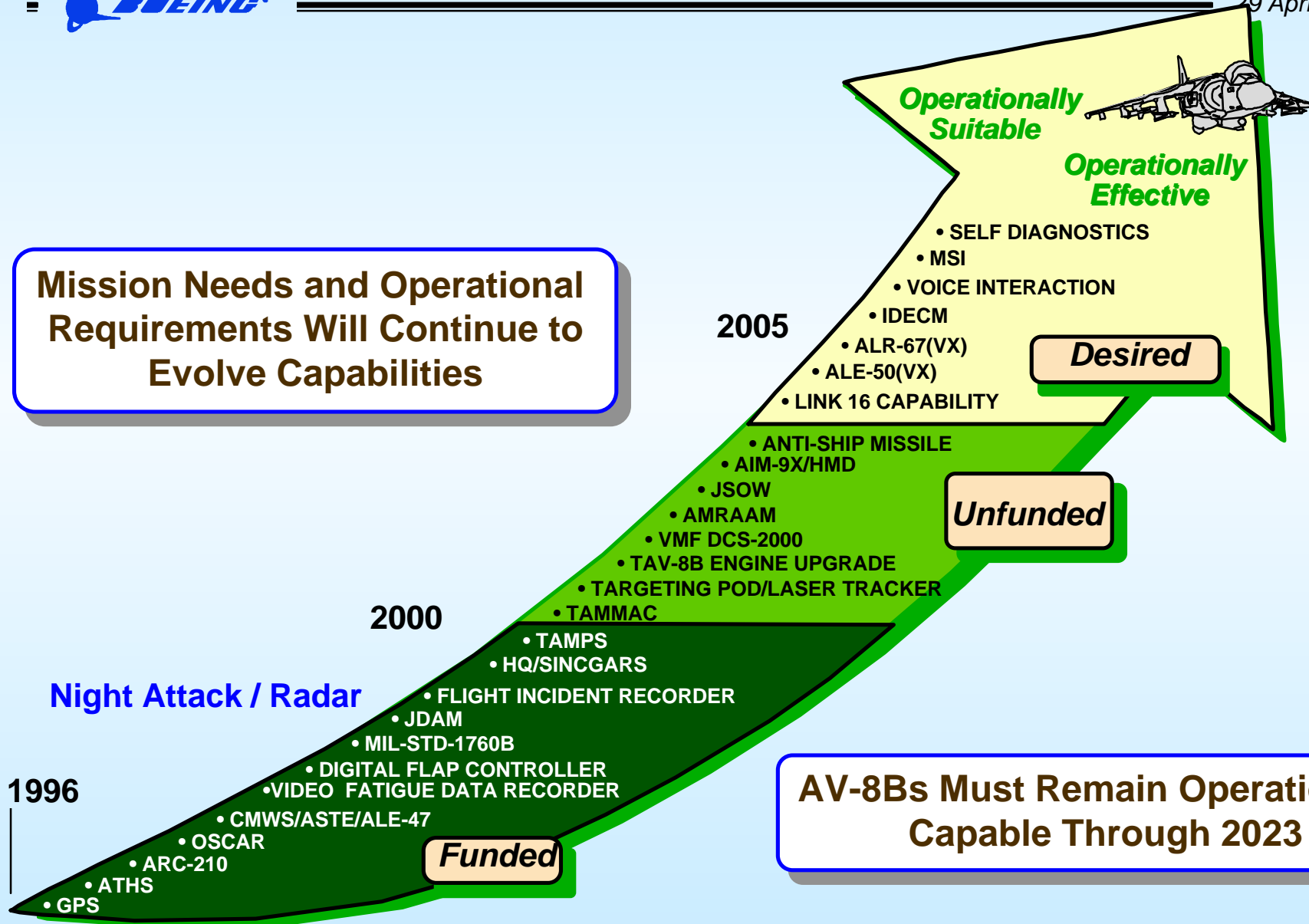
AV-8B Operational Requirements

OSCAR — AV-8B OPEN SYSTEMS CORE AVIONICS REQUIREMENT

29 April 1998

Operationally Suitable

Operationally Effective

Mission Needs and Operational Requirements Will Continue to Evolve Capabilities

2005

- SELF DIAGNOSTICS
- MSI
- VOICE INTERACTION
- IDECM
- ALR-67(VX)
- ALE-50(VX)
- LINK 16 CAPABILITY

Desired

- ANTI-SHIP MISSILE
- AIM-9X/HMD
- JSOW
- AMRAAM
- VMF DCS-2000
- TAV-8B ENGINE UPGRADE
- TARGETING POD/LASER TRACKER
- TAMMAC

Unfunded

2000

Night Attack / Radar

- TAMPS
- HQ/SINCGARS
- FLIGHT INCIDENT RECORDER
- JDAM
- MIL-STD-1760B
- DIGITAL FLAP CONTROLLER
- VIDEO FATIGUE DATA RECORDER
- CMWS/ASTE/ALE-47
- OSCAR
- ARC-210
- ATHS
- GPS

1996

Funded

AV-8Bs Must Remain Operationally Capable Through 2023

AV-8B Avionics System
Harrier II Plus

Control and Display

HUD — Video Camera
CDM — EPI
CDC
MPCD (L) — MPCD (R)
Display Computer
Digital Map Computer — Video Recording Set
Digital Memory Unit

Flight Control
Sensors — Flight Control Computer
Control Surfaces — Pedal Shakers

Navigation/Recording
MAD — INS
Sensors — ADC
Data Storage Set
Engine Monitoring Set

Data Processing
Mission Computer
Remote Control
ACNIP

GPS
TACAN
Radar Alt
CNI Data Converter
IFF
UHF/VHF Radio 1
UHF/VHF Radio 2

Communication Radio Navigation Identification
AWLS
Beacon R/T
IFF Crypto
KY-58 Secure Voice No. 1
KY-58 Secure Voice No. 2

Radar — NAV/FLIR
Tactical Sensors

Control Indicator
Stores Management
Enhanced Stores Management Control Set

Radar Warning Receiver — Interference Blanker
Countermeasures Dispenser
Electronic Warfare

HOTAS
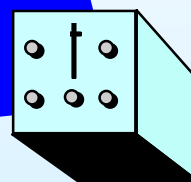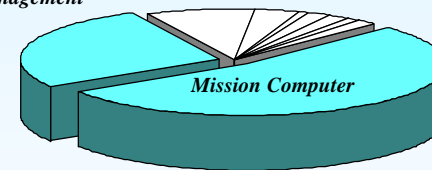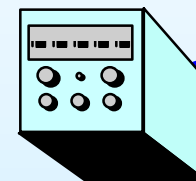A/G Weapons — Gun — AIM-9
DECM Pod — ASPJ Provisions

AV8BAVN2.CVSS

Two Components Impact ~ 75%
of Routine Update Maintenance Cost

Stores Management Computer

Mission Computer

Mission Computer
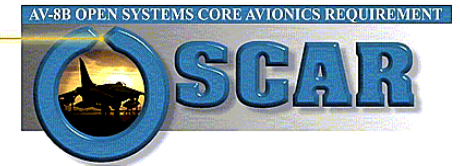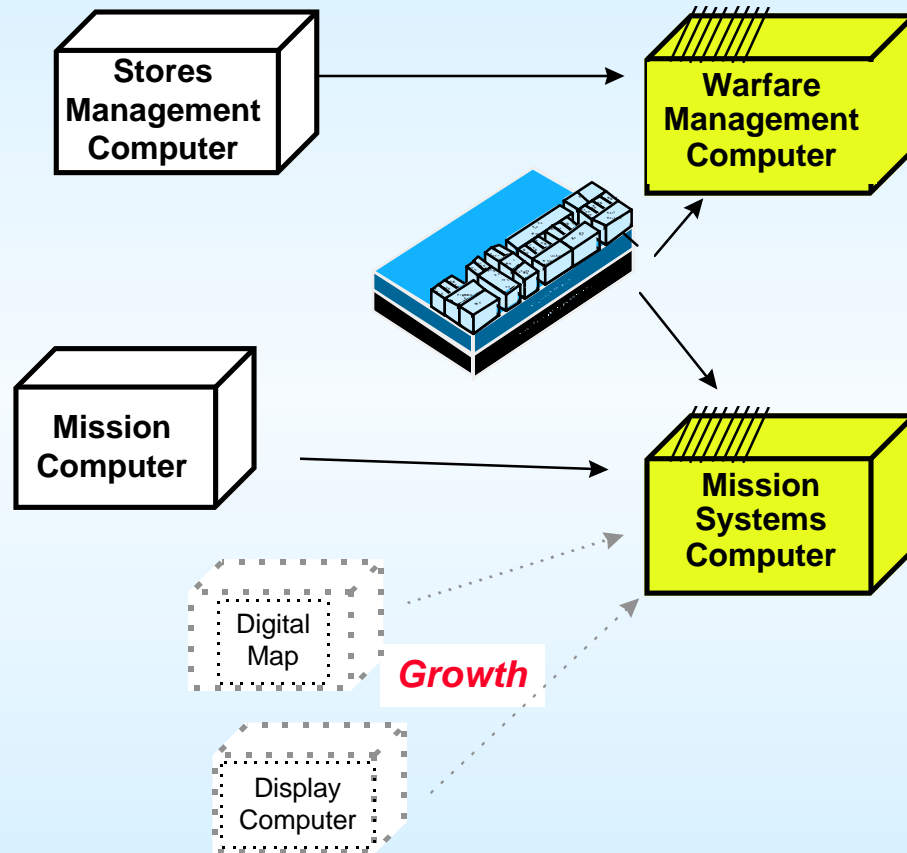
Stores Management Computer

Addresses The High Payoff Areas

The OSCAR Solution

Stores Management Computer → **Warfare Management Computer**

Mission Computer → **Mission Systems Computer**

Digital Map

Growth

Display Computer

Modular Avionics
- Retains Form, Fit , Function
- VME 64 Backplane
- VME 6U Form Factor

Modular Software
- Reusable Across Platforms
- Hardware Independent
- OO Design, C++
- Well Defined Interfaces
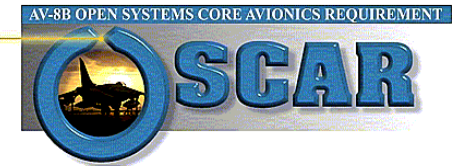
Reduced Support Cost
- O to OEM 2-Level Maintenance
- Extended Warranty
- Guaranteed Turn-Around Time

Streamlined Acquisition
- Performance Specs
- Leverage Off Commercial Mkt
- CM Controlled by Prime

Meets Today's Requirements While Positioning for Future Growth

Program Funding Sources

- AV-8B JPO (USMC/Spain/Italy)
- DBOF
- CTIP
- COSSI

General Dynamics
Information Systems
Minneapolis, MN

Boeing/Alenia
St. Louis, MO

Smiths Industries
Florham Park, NJ

NAWC-WD
China Lake, CA

Raytheon Radar
Los Angeles, CA

Tracor Aerospace
Austin, TX

Smiths Industries
Clearwater, FL

OSCAR Schedule Summary

AV-8B OPEN SYSTEMS CORE AVIONICS REQUIREMENT
OSCAR

BOEING

29 April 1998

1996	1997	1998	1999	2000
A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D

Milestones
▽ MS II   ▽ MS III   △ FPR

Airframe Modification

Kit Design & Fabrication   A/C 284   A/C 179   A/C 205   A/C 168   A/C 234   A/C TBD

1760 / AMRAAM
F.T. Kit Delivery   Val Ver.Kit Delivery

1760 Retrofit   1   2   2 2 2 2 2
1 1 1 1 1
1760 Prod Incorp

Kit Design & Fabrication   A/C 179   A/C 284

ALE-47 / CMWS
F.T.Kit Delivery   Prod Rel Kit Delivery   CMWS Sensor Delivery

Hardware Deliveries

WMC   EM (2)   EM (2)   PRU   PRU (4)   PRU (2)   WMC/MSC Delivery to MDA

MSC   EM Units(4)   PRU Units(10)

System/Software Development

System/Software Iterations

Software Architecture
Requirements Analysis

Production Go-Ahead   Retrofit Contract Award   Retrofit Follow-On Buy Approval

I1   I2   I3   I4   I5   I6   I7   I8   Production Go-Ahead

OC1.1 (1760 / AMRAAM)

OARR
FFRR   OA   VRF   OTRR
MSC/RDR   Full Avionics DT & E   DT/OT   OT & E   Report

ALE-47   CMWS   AMRAAM Live Fires   OC1.1 Release

ASTE / CMWS (Development Program)

Bench Testing   AIC Integration   Dev. Flights   DT/EOT
ASTE Sep.

CMWS MS III

OC1.2 (JDAM / CMWS / ALE-47)

DT&E
Requirements Specification & Iterative Development   OT&E
OC1.2 Release

1996	1997	1998	1999	2000
A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D

5 May 97

OSCAR is an Open System Architecture Which Standardizes Physical, Electrical, and Software Interfaces at Line Replaceable Module Level...
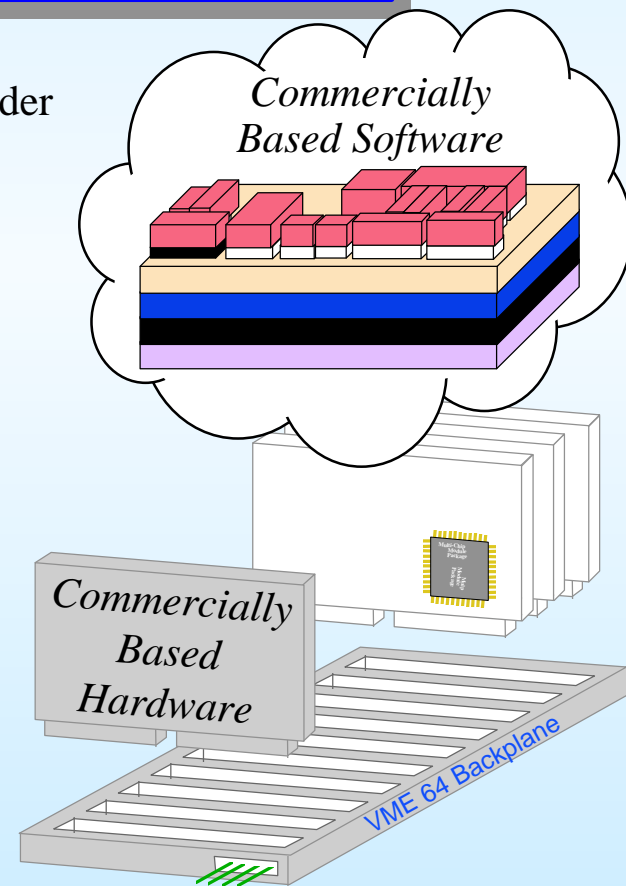
- **Software**
  - Commercially Supported, Objected Oriented, High Order Language (e.g. C++)
  - COTS Development Tools and Processes
  - IEEE/ANSI STD P1003 POSIX Compliant Real-Time Operating System (e.g. VxWorks)
  - COTS Software Components (e.g. VME Drivers and Interrupt Handlers)
  - Industry STD CORBA Compliant Application Program Interface (API)

- **Mechanical**
  - IEEE 1101.2 Conduction Cooled VME 6U Module

- **Electrical**
  - ANSI/VITA STD 1-1994 VME-64 Backplane Bus
  - ANSI STD X3.230-1994 Fibre Channel Bus (Growth)
  - IEEE STD 802 Ethernet Development Interface
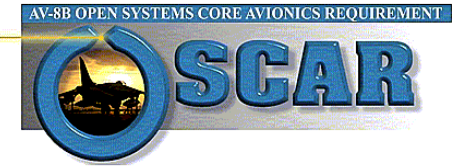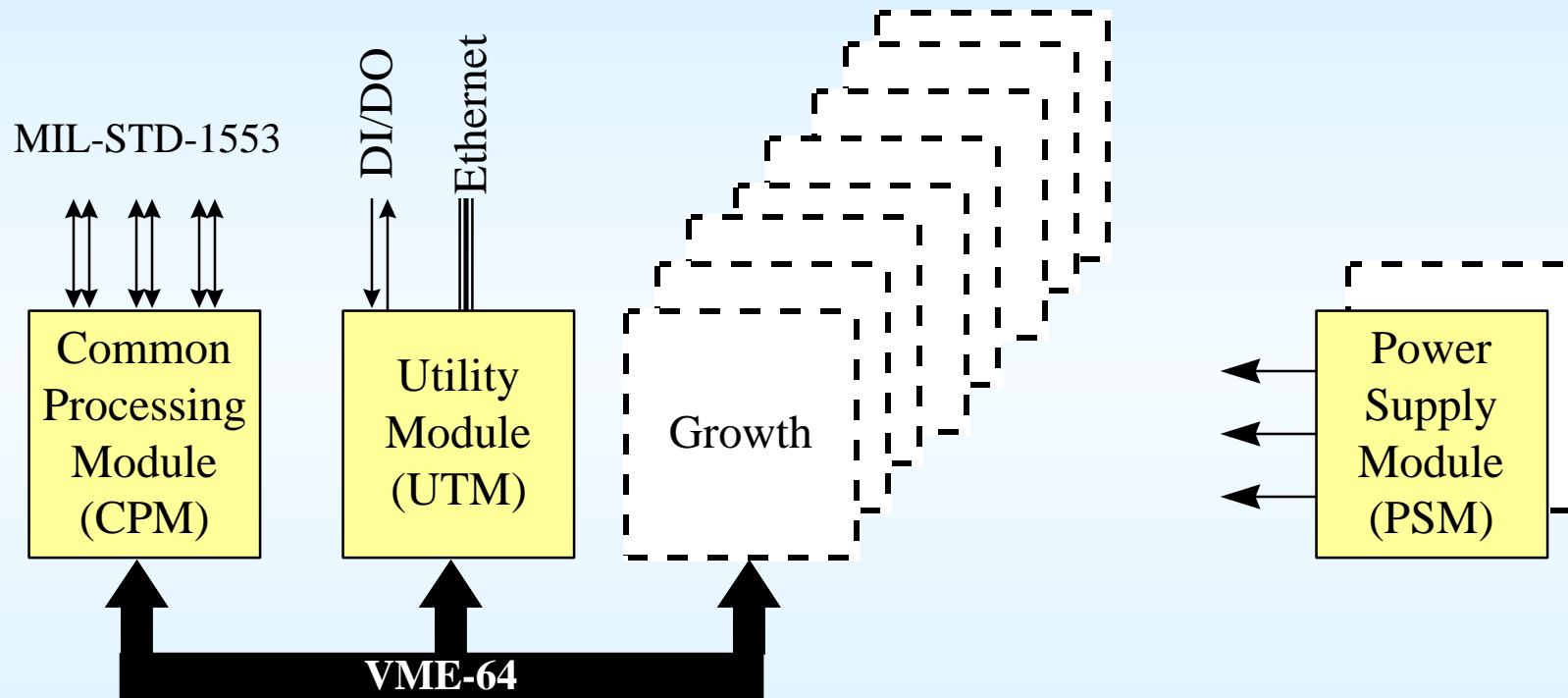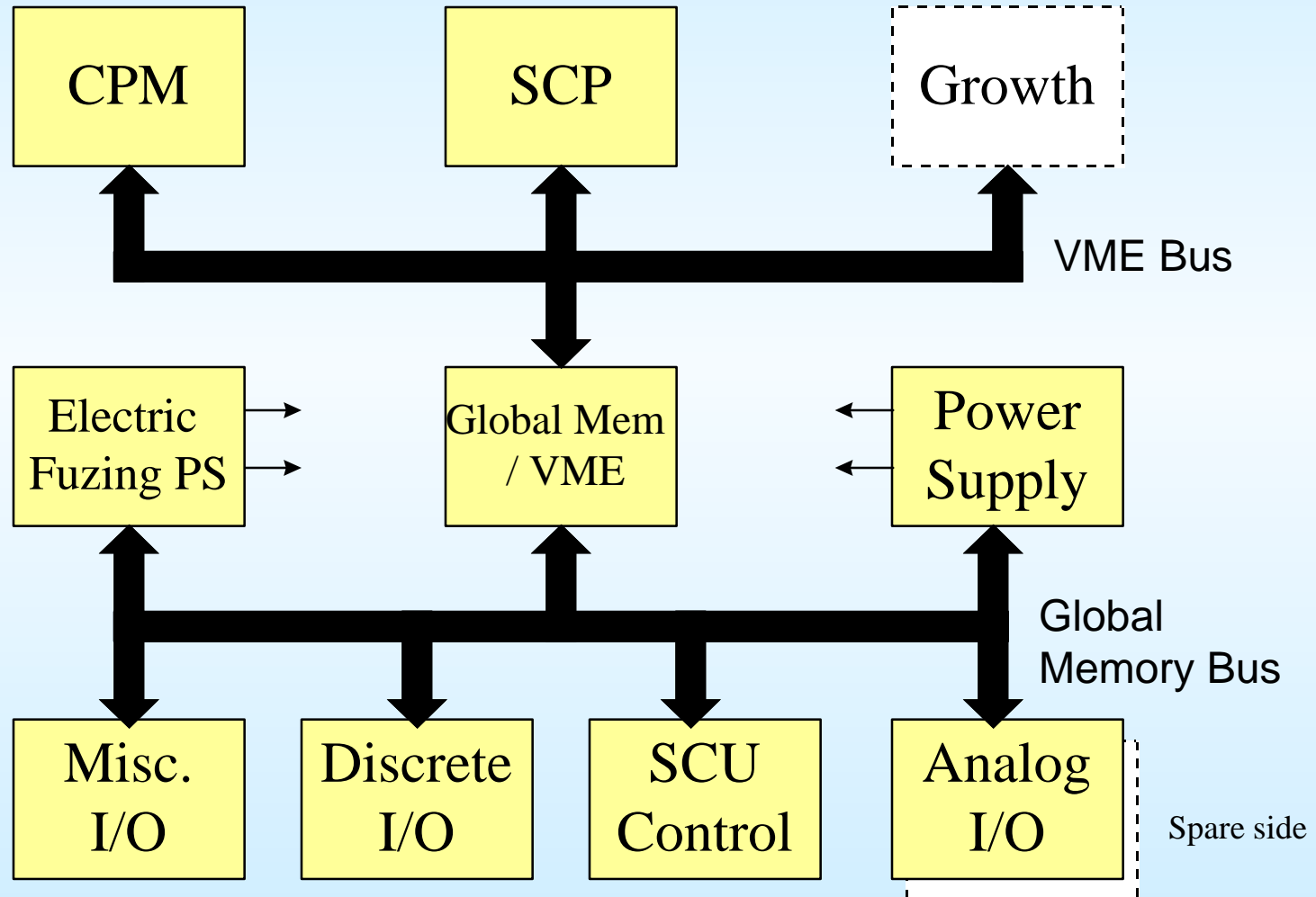
Commercially Based Software

Commercially Based Hardware

VME 64 Backplane

MIL-STD-1553

DI/DO

Ethernet

Common Processing Module (CPM)

Utility Module (UTM)

Growth

Power Supply Module (PSM)

VME-64

CPM Commonality

Memory
Mezzanine
16, 32 or 64MB

MIL-STD-1553
Mezzanine
1, 2, or 3 channels

GDIS

MSC

CPM

Dy-4

Smiths

WMC
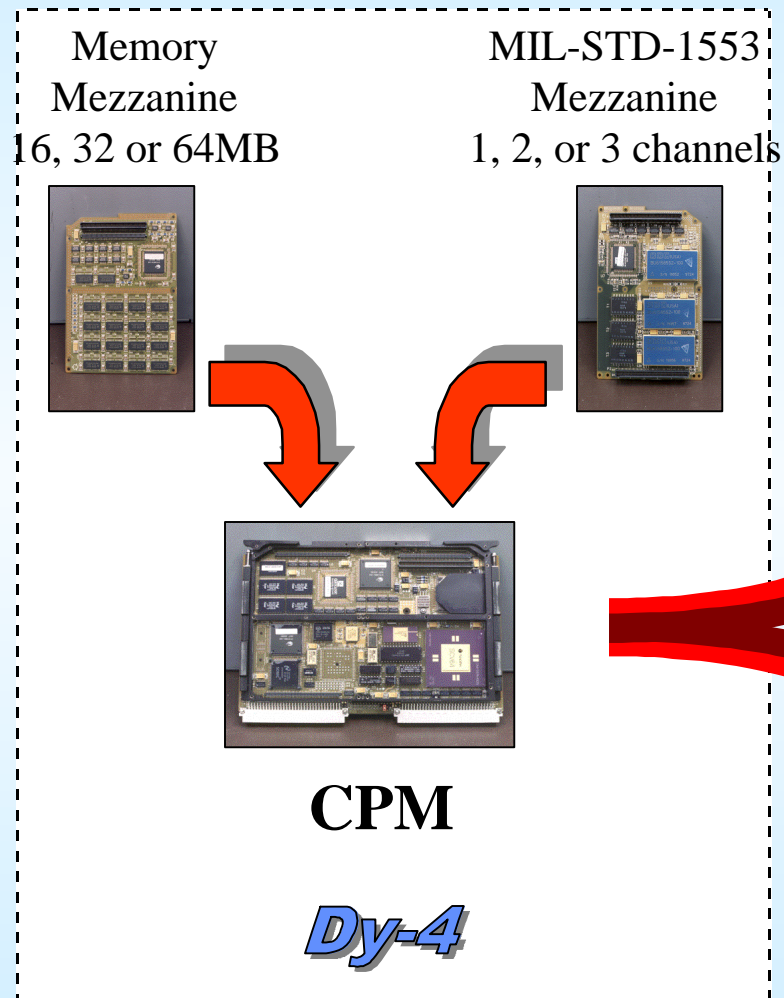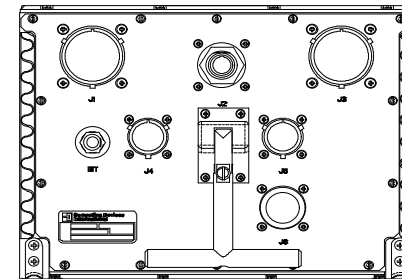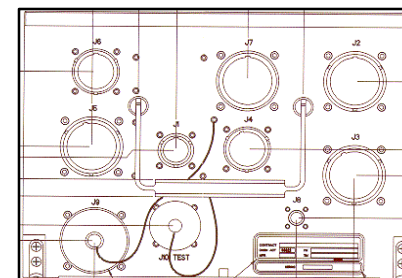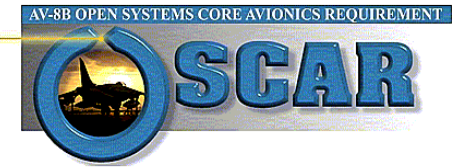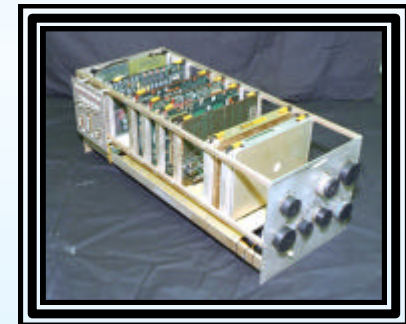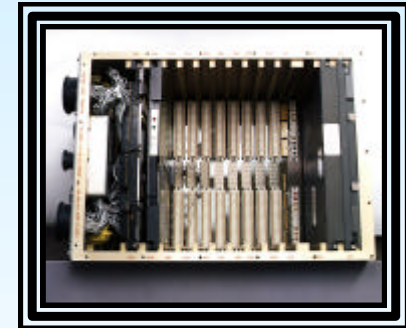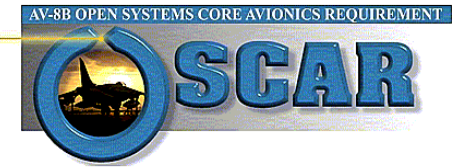
- ## Mission Systems Computer (GDIS)
  - ❑ **All Subsystem CDR Actions Closed**
  - ❑ **All EMD Units Delivered to Boeing (4)**
  - ❑ **Production Relevant Units Delivered (6)**

- ## Warfare Management Computer (Smiths Industries)
  - ❑ **All Subsystem CDR Actions Closed**
  - ❑ **All EMD Units Delivered to Boeing (4)**
  - ❑ **Production Relevant Unit Delivery - Jul 98**

- ## ALE-47/39 Module (Tracor Aerospace)
  - ❑ **All Subsystem CDR Actions Closed**
  - ❑ **EMD Units Delivered to Boeing (4)**
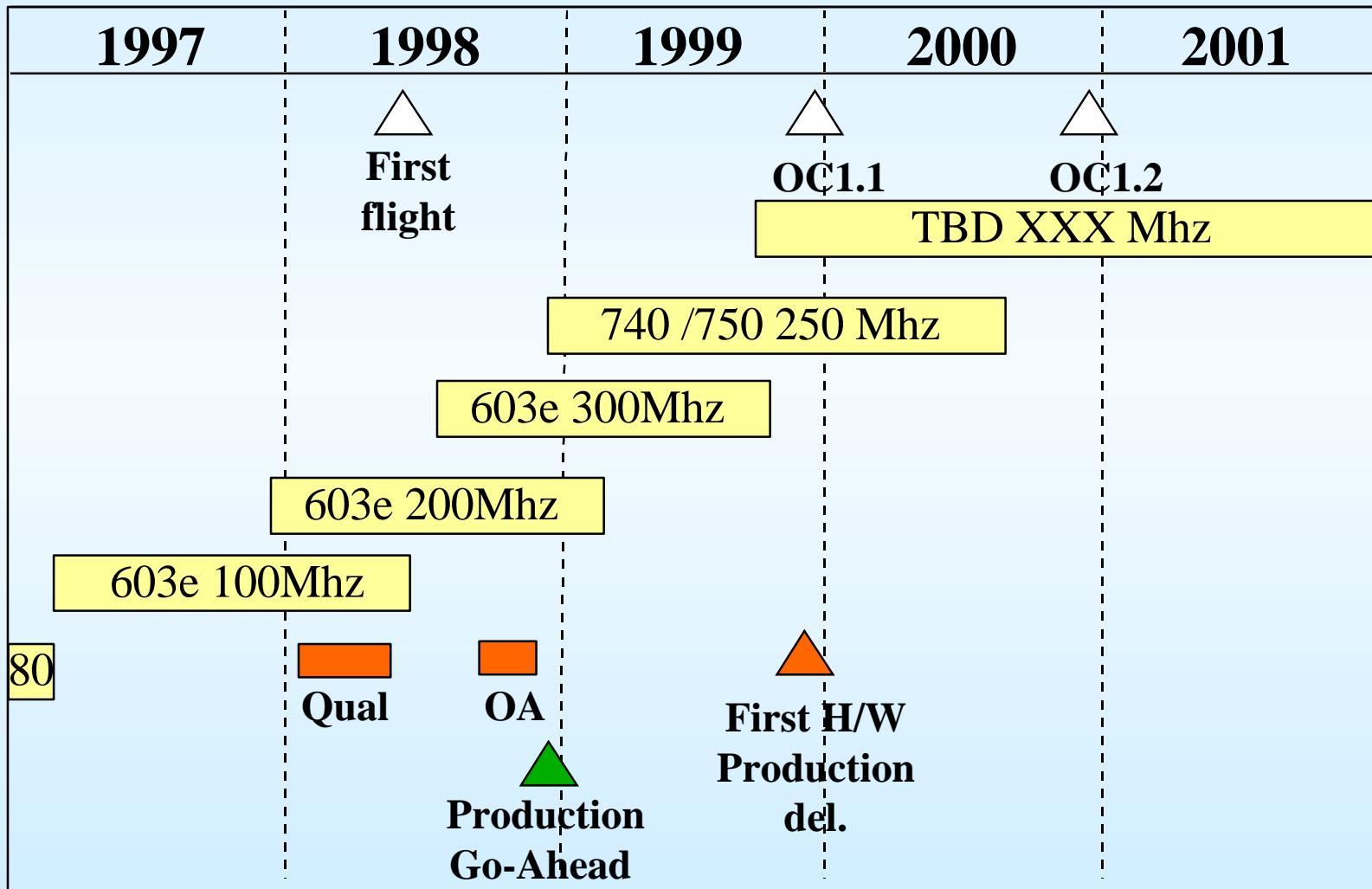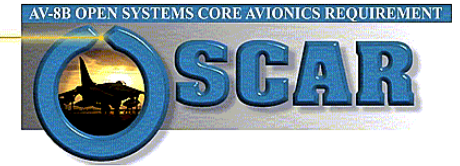 - ❑ **Production Relevant Unit Delivery - Jun 98**
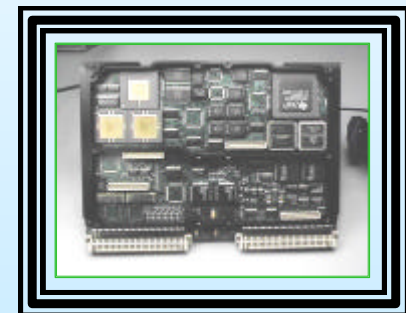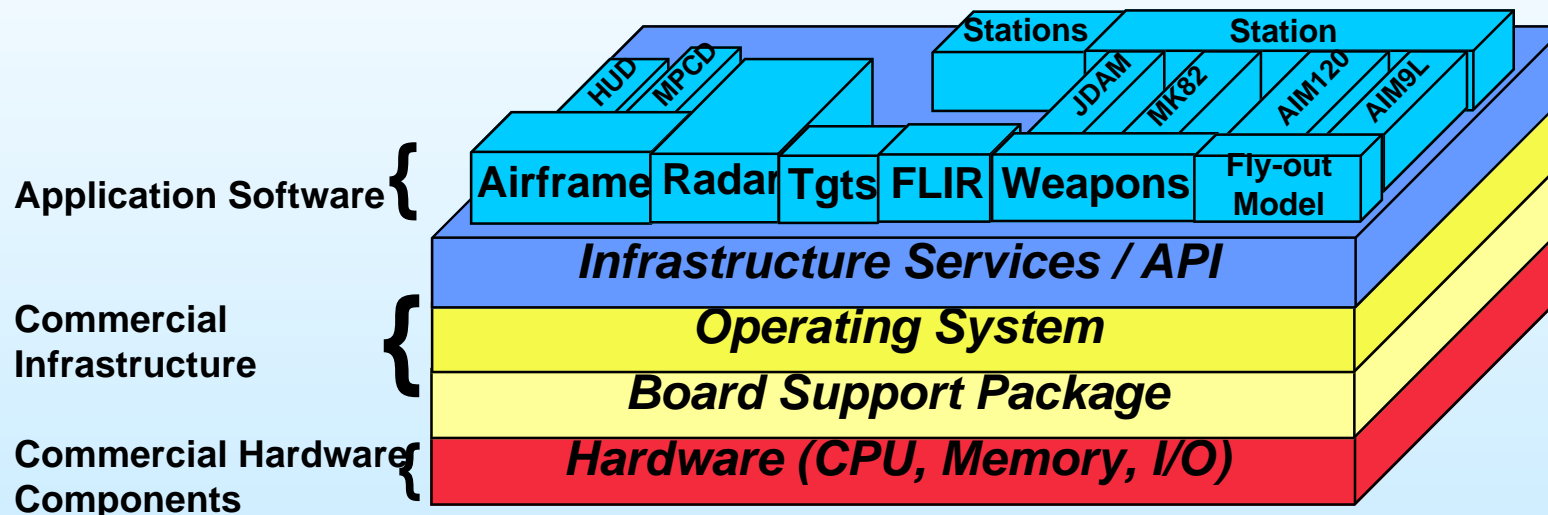
Technology Roll Plan

29 April 1998

1997	1998	1999	2000	2001

First flight

OC1.1

OC1.2

TBD XXX Mhz

740 /750 250 Mhz

603e 300Mhz

603e 200Mhz

603e 100Mhz

80

Qual

OA

First H/W Production del.

Production Go-Ahead
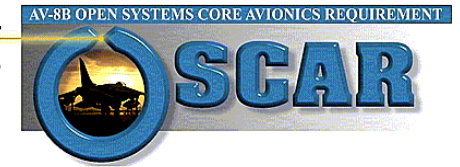
OSCAR Software Architecture

OSCAR Code & Design Reuse

- Hardware Independence
- Tools/Process Reuse
- Reuse In Non-Flight Domains - Simulators, Trainers, Maintenance
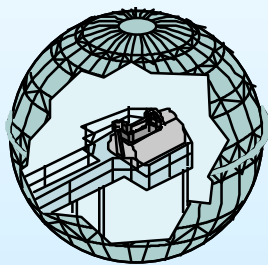- Reduced Regression Testing

Application Software {
- HUD
- MPCD
- Stations
- Station
- JDAM
- MK82
- AIM120
- AIM9L
- Airframe
- Radar
- Tgts
- FLIR
- Weapons
- Fly-out Model

Infrastructure Services / API

Commercial Infrastructure {
- *Operating System*
- *Board Support Package*

Commercial Hardware Components {
- *Hardware (CPU, Memory, I/O)*

OSCAR Software Engineering Environment
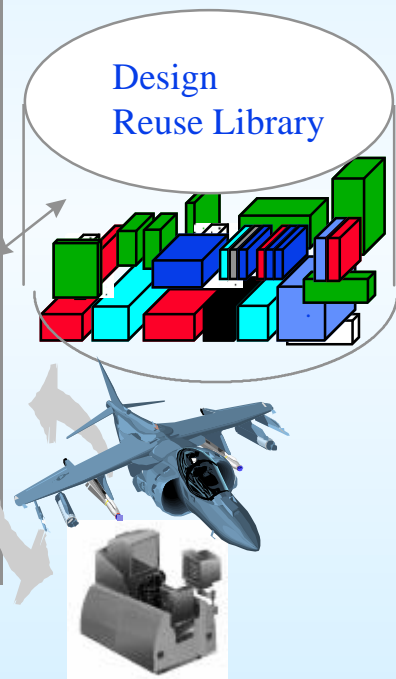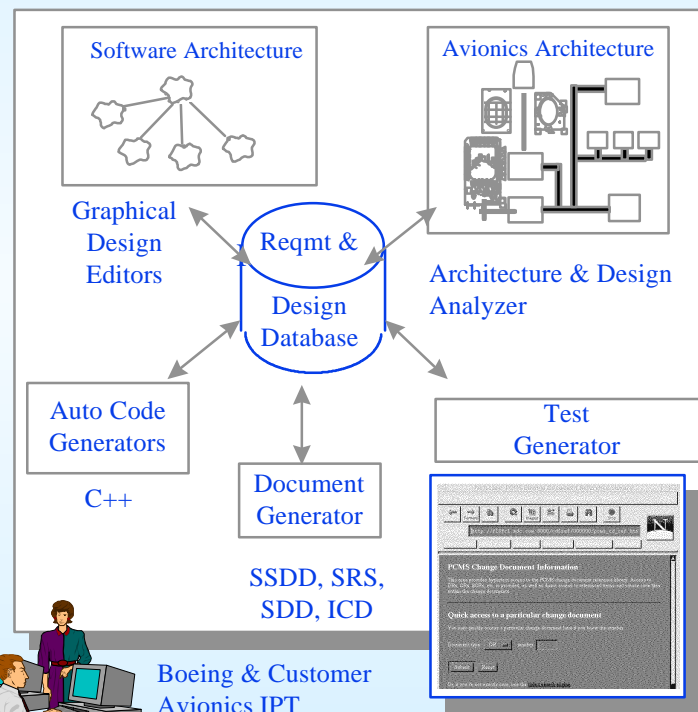
BOEING

Re-Inventing the SW Process

- **Object Oriented Design**
- **Auto Code Generation**
- **Reuse Libraries**
- **Rapid Prototyping**
- **Commercial Environments**
- **Reduced Regression Testing**

Software Architecture

Avionics Architecture

Design Reuse Library

Graphical Design Editors

Reqmt & Design Database

Architecture & Design Analyzer

Auto Code Generators
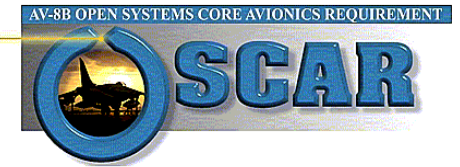
C++

Document Generator

Test Generator

SSDD, SRS, SDD, ICD

Boeing & Customer Avionics IPT

Integrated Process and Tools

Open System Benefits

- **Commercial Processor Marketplace Leverage**
  - ❑ Started with 80MHz, 100MHz Upgrade, 200MHz Today
  - ❑ Reduced Upgrade Cost/Schedule/Risk

- **Commercial Hardware Improves "Time to Market"**
  - ❑ Solutions Readily Available
  - ❑ Used Commercial Convection Cooled Hardware for Prototype

- **Commercial Software Marketplace Leverage**
  - ❑ Tools Available Now
  - ❑ No NRE Required for Development

- **Interfaces Already Defined**
  - ❑ Less Upfront Technology Investment Required
  - ❑
  - ❑
  - ❑

"Better/Faster/Cheaper"
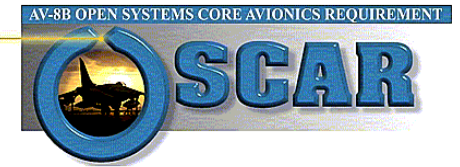
- **High Performance 1553 Not Commercially Available**
  - ❏ Some Development Required

- **Adequate Memory/Throughput**
  - ❏ Difficult to Achieve with Current Technology(1553 Overhead)
  - ❏ Commercial O/S Adds Processing Overhead

- **Test Philosophy Does Not Support Rapidly Changing Technology**
  - ❏ Typical Flight Test Program is 12-18 Months
  - ❏ Processor Technology Roll is Less than 12 Months

- **Avionic Environment Difficult to Achieve at "71°C"**
  - ❏ Some Trade-offs Required

  - ❏
  - ❏

Benefits of Open Systems Far Outweigh Challenges